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The Cross-Section of Stock Returns in an Early Stock Market*

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Abstract: Using a new dataset which contains monthly data on 1,015 stocks traded on the London Stock Exchange between 1825 and 1870, we investigate the cross section of stock returns in this early capital market. Unique features of this market allow us to evaluate the veracity of several popular explanations of asset pricing behavior. Using portfolio analysis and Fama-MacBeth regressions, we find that stock characteristics such as beta, illiquidity, dividend yield, and past-year return performance are all positively correlated with stock returns. However, market capitalization and past-three-year return performance have no significant correlation with stock returns.

Keywords: Cross-sectional stock returns; Anomalies; Size effect; Value effect

JEL classifications: G12; N23

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1. Introduction

The patterns of cross-sectional stock returns (e.g., size effect, value effect, reversal effect, momentum effect etc) have been documented by many studies of modern financial markets (Banz, 1981; De Bondt and Thaler, 1984; Rosenberg et al., 1985; Fama and French, 1992; Jegadeesh and Titman, 1993). These phenomena are sometimes called "anomalies" because these return patterns appear not to be explained by the classical asset pricing models. Since their discovery, a large strand of theoretical and empirical work has attempted to provide rationalization for these stock market "anomalies". First, several studies have proposed risk-based explanations (Zhang, 2005; Liu, 2006; Hahn and Lee, 2006; Xing, 2008; Campbell et al., 2010). Among these, a well-known risk explanation for the size and value effect is that market capitalization and value indicators (e.g., B/M ratio, dividend yield, price earnings ratio) capture the distress risk omitted by standard asset pricing models (Chan and Chen, 1991; Fama and French, 1993, 1995, 1996; Ferguson and Shockley, 2003). Second, many studies try to explain the anomalies using behavioral biases in individual decision-making. For example, investor overreaction has been proposed as an explanation for the value and the reversal effects (Lakonishok et al., 1994; De Bondt and Thaler, 1984, 1987; Daniel et al., 1998). Third, some studies argue that the institutional environment, such as tax or the behavior of institutional investors, helps to explain the anomalies (Jiang, 2010; Gompers and Metrick, 2001). One example is the tax-loss selling hypothesis, which has been an important candidate explanation for the January effect and the reversal effect (Reinganum, 1983; George and Hwang, 2007). Fourth, Lo and MacKinlay (1990) and Black (1993) highlight a potential data-snooping bias in the tests for anomalies, thus casting doubt on their very existence in the first place.

As modern global financial markets have become increasingly integrated, Schwert (2003) points out that repeatedly rediscovering similar results from positively correlated samples may not provide much additional evidence in favor of the "anomalies". Therefore asset pricing behavior in a large, non-US market in the nineteenth century may provide strong out-of-sample evidence. Consequently, in this study, using a unique dataset that contains monthly data on 1,015 stocks traded on the London Stock Exchange from 1825 to 1870, we investigate the cross-section of stock returns in this early stock market. We focus on two of the best known stock pricing patterns, namely the size effect and value effect, but we also examine the relation between stock returns and several other stock characteristics, including beta, illiquidity, past one year performance, and past three year performance.

The motivations for this study are threefold. First, apart from the possibility of a data-snooping bias, the recent disappearance of the size effect (Dimson and Marsh, 1999; Hirshleifer, 2001; Amihud, 2002) has raised further questions about the robustness of asset pricing anomalies. Alternatively, Schwert (2003) suggests that it is probable that the anomalies were always in existence, but they have been arbitraged away following their discovery. It is also possible, however, that the disappearance of the anomalies may itself be a temporary phenomenon. An investigation of asset pricing behavior in historical financial markets, particularly one from a period long before the discovery of the anomalies, may help to shed some light on these issues as well as indirectly testing the data-snooping hypothesis.

Second, investigating asset pricing behavior in the nineteenth-century London market can be viewed as a natural experiment which allows us to examine asset pricing in the absence of influential factors such as taxes and institutional investors. To begin with, the London market operated in a laissez-faire environment, with zero corporate taxes, capital gain taxes and near-zero income taxes, minimal listing requirements, and very little in the way of statutory investor protection and securities law (Turner et al., 2013). Therefore, hypotheses that rely on taxes to explain stock return patterns do not apply in this market. Several studies document the influence of institutional investors upon stock pricing for modern markets (Gabaix et al., 2006; Jiang, 2010; Da and Gao, 2010). Institutional investors' trading activities, however, do not influence stock returns in our sample as they did not invest in the equity market during this era (Turner et al., 2013). In addition, to the extent that individual investors are less rational than professionals, any stock return patterns that arise due to individual investors' behavioral biases should be particularly pronounced in a market where individual investors dominate.

This unique institutional environment in the nineteenth-century London market provides a good opportunity to evaluate two competing theories of the long-term reversal effect: the tax-loss selling hypothesis and the overreaction hypothesis. In particular, in this historical market, we should not observe the reversal effect if the tax-loss selling hypothesis holds and there should be a strong reversal effect if the overreaction hypothesis holds.

Third, although only stocks with limited liability are traded on modern markets, this was not the case in the British stock market over our sample period, since there existed stocks with extended liability (i.e., unlimited liability, double liability or partially-paid stocks) as well as standard limited liability stocks (Acheson et al., 2012). The coexistence of both types of stocks makes it possible to test the distress-risk explanation of the size and value effects. Stocks with extended liability existed to protect creditors from expropriation because, in the event of bankruptcy, shareholders had to cover the company's debt out of their personal wealth. Therefore, the costs to shareholders related to financial distress or bankruptcy would be larger for stocks with extended liability. Thus, one would expect that the returns of these special stocks should therefore be much more sensitive to distress risk than the returns of standard stocks. In addition, if size or value indicators capture the distress risk of the firm, we should observe a stronger size effect or value effect within the subsample of special stocks than in the subsample of standard limited liability stocks. We exploit this unique feature of this early stock market to test whether this was indeed the case.

This study contributes to the strand of literature that has investigated the pattern of cross-sectional stock returns in the UK market (Levis, 1989; Strong and Xu, 1997; Morgan and Thomas, 1998; Dissanaike, 1999; Liu et al., 1999; Gwilym et al., 2000; Gregory et al., 2001;

Hon and Tonks, 2003; Morelli, 2007). This study also contributes to the literature which has investigated cross-sectional stock returns in historical financial markets. Korolenko and Baten (2005) demonstrate the existence of the size effect in the German stock market in the period 1871 to 1914. However, Bossaerts and Fohlin (2000) find the opposite using annual data on 50 companies from 1881 to 1913. Fohlin and Reinhold (2010) demonstrate a negative book-to-market effect in their sample with monthly data on 37 firms, covering the period 1904 to 1910. For the UK market, using annual data for 1871 to 1913, Grossman and Shore (2006) find no size effect and some evidence of a value effect.

Our paper, however, represents large improvements over previous studies on historical stock markets. First, we examine stock returns in Britain, which had by far the most developed capital market in the nineteenth century. Second, we use a comprehensive dataset of stocks traded on the London Stock Exchange over a relatively long period (45 years). This dataset covers a broad range of sectors in the economy and is thus free from survivor bias. Third, we address the delisting bias problem in our empirical analysis. Fourth, as well as extending the analysis of Grossman and Shore (2006) further back to a more formative stage of the British stock market, we use monthly data, which allows us to use Fama and MacBeth (1973) regressions.

Our findings suggest that there is little evidence of a size effect in this early market. On the other hand, using dividend yield as the indicator of value and growth, we find strong evidence of a value effect. Both of these findings are robust to a battery of robustness checks. The cross-sectional regression analysis demonstrates that special stocks (i.e., stocks with extended liability and partially-paid capital) do not seem to have stronger value premiums than standard fully-paid limited liability stocks, suggesting that distress risk is not a plausible explanation for the value effect. The Fama-MacBeth regression analysis also indicates that, similar to the results from modern stock markets, stock returns in this historical market are positively correlated with beta, illiquidity and momentum measures. However, we find that stock returns in our sample are uncorrelated with the reversal variable, which indicates that the reversal effect which exists in modern markets may not exist in our sample.

Our out-of-sample study of the stock pricing behavior in this nascent stock market allows us to evaluate various explanations for the patterns of stock returns. The absence of a size effect in our sample and in Grossman and Shore (2006) corresponds to the evidence that the size effect in the US market disappeared in the post-1980s era. Taken together, this suggests that the size effect may not be a perennial feature of equity markets. It is also consistent with the data-snooping explanation for the size effect. Contrastingly, the value premium tends to be much more persistent as it exists in both historical and modern stock markets, perhaps suggesting that the value effect may not be an "anomaly" after all. However, our evidence provides no support for the distress risk explanation of the value effect, which corresponds to the findings of Dichev (1998) and Campbell et al. (2008), who suggested that the distress risk premium in the modern stock market is negative rather than positive. Finally, the absence of a reversal effect in this era is consistent with the tax-loss selling hypothesis rather than the overreaction hypothesis.

This paper is structured as follows. Section two describes the data used in this study. Section three focuses on the performance of size-sorted and dividend-yield-sorted portfolios. We also consider the delisting-bias-adjusted portfolio returns as well as portfolio returns which take into account the influence of market risk as well as *SMB* and *HML* factors. In addition, we discuss the results of several robustness tests within the portfolio framework. In section four, we investigate the relationship between stock returns and stock characteristics using the Fama-MacBeth regression methodology. Section five concludes.

2. Data sources

The stocks employed in this study are the constituents of the nineteenth-century stock indices constructed in Acheson et al (2009). The main data source is the *Course of the Exchange* (*COE*), which from the beginning of the nineteenth century was the official price list for the London Stock Exchange (LSE). Although the LSE at this time did not have any restrictions on securities that could be traded on the floor, not every security obtained a quotation on the market's official list. A company's inclusion on the official list was mainly based on the anticipation of potential trading which generated business for the LSE (Michie, 1999, pp.86-7, 96). The prices printed in the official list are usually the transaction prices from the previous day, which were obtained from the floor through the process called "marking a bargain" (Wither, 1910, p.258).[1] The market was usually made by stock jobbers, who acted as intermediaries between brokers, who were buying and selling on behalf of their clients.[2] The brokers received commissions from their clients and the jobbers got their profits from the bid-ask spread (Michie, 1999, pp.119-20).

For listed securities, the *COE* reported dividends, transaction prices from the last trade of the day, number of issued shares, nominal and paid-up values of stock. We hand-collected this data for each common stock listed in the *COE* for every month between March 1825 and December 1870.[3] The entire dataset contains 122,414 observations, consisting of 1,015 common equity stocks issued by 681 companies. These companies were from a wide range of sectors, including banks, bridges, mining, canals, docks, gas-light and coke, insurance, roads, railways, telegraphs, waterworks, and miscellaneous industrial and commercial firms.

As can be seen from Table 1, which displays the descriptive statistics for the main variables in the dataset, stocks typically had high denominations in this early capital market, and around half of the observations in the dataset are for stocks which were partially-paid or had extended shareholder liability.

<INSERT TABLE 1>

Although our dataset represents the best available data for the stock market in the 1825-70 period, it differs from modern stock data in several ways. First, there was thin trading of stocks in this period. At a monthly frequency, about 23% of observations have no stock price quotations due to not being traded. As a result, returns for the months with no quotations cannot be calculated. Since the severity of this problem across stocks may be correlated with stock characteristics (e.g., size and value), omitting observations with no prices may introduce a selection bias into our analysis. We therefore use three methods to alleviate this problem. In the first method, we fill in months which have no quotations with the last available price for the same stock. In the second method, for the months when trades did not occur, stock returns are set equal to the average monthly returns for the same stock over the sample period. The final method simply excludes from the analysis the observations with no price quotations. Since our results are not sensitive to which method is used, we only report the results from the third method.

Second, the *COE* lacks information about why stocks delisted from the LSE and the related delisting return. As ignoring delisting returns when evaluating stock performance could induce a bias (Shumway, 1997; Shumway and Warther, 1999), we take several steps in section three to correct for any such bias.

Third, good quality accounting data which would enable us to calculate a book-to-market ratio does not exist for most of the stocks in our dataset. Consequently, in order to identify the growth and value features of a stock, we use the dividend yield, defined as the sum of dividend paid in the year divided by the end-of-year stock price, as the measure of value.[4]

3. Performance of size and dividend-yield-sorted portfolios

3.1 Summary statistics and returns on size and dividend-yield-sorted portfolios

Given the importance and ubiquity of the size and value effects, this section examines the performance of size and dividend-yield-sorted portfolios using the portfolio approach. At each December, we divide the selected sample of stocks into five portfolios according to the ranking of their market capitalization or annual dividend yield. A stock had to have a price observation in December and have been listed for at least six months in the prior year in order to be included in any portfolio. These restrictions are imposed in order to compute the updated market capitalization and comparable liquidity measures for each stock.

Both the 1-month and 12-month holding-period returns in the year after the portfolio formation are calculated for the five portfolios. The monthly return for a stock is the sum of its monthly capital gain and its monthly dividend yield. Since the dividend rates for each stock in our dataset are annual, we follow Fama and French (1998) by dividing the annual dividends by 12 when calculating the monthly dividend yield. This treatment assumes that the capital gain component of the return has the volatility and covariance structure of the total return. The 12-month holding-period returns are the sum of annual capital gains and dividend yields, with annual capital gain calculated as the continuously compounded monthly capital gain, and the annual dividend yield calculated as the sum of dividends paid by the stock in the year divided by the beginning-of-year stock price. To avoid the influence of outlier returns on our portfolios, we winsorize returns at the 0.005 and 0.995 percentiles. The return of a portfolio is the average return of its constituent stocks. We report the results for the equally-weighted portfolio returns because such a weighting methodology better reveals the features of the average stock.[5]

The process of portfolio formation and return calculation is repeated for every December between 1825 and 1870. Then, for each portfolio, we calculate the time-series average of 540 months (i.e., from January 1826 to December 1870) of 1-month holding-period returns and the time-series average of 45 years (i.e., from 1826 to 1870) of 12-month holding-period returns. The performance of various portfolios is compared and the existence of a size or value premium is identified mainly through testing whether the differential returns between the top and bottom portfolios are statistically different from zero.

Table 2 displays the time-series average of several important variables across the 45 formation Decembers for the portfolios formed on size. For comparison purposes, it also reports the statistics for the 1871-1913 British market and the 1926-1999 CRSP dataset, both of which are based on statistics provided in Grossman and Shore (2006).

<INSERT TABLE 2>

Table 2 shows that dividends played an important role in the nineteenth-century British stock market. All five portfolios formed on size have dividend yields above 4%. Compared with Britain in the 1870-1913 period and the modern US market, small stocks performed better in terms of dividend payments in pre-1870 Britain. On average, around 39% of the smallest quintile of stocks did not pay dividends in a particular year in our dataset, while around 48% and 66% of the smallest quintile of stocks paid zero dividends in the 1870-1913 British dataset and the 1926-1999 CRSP dataset respectively. In addition, small stocks were also more likely to pay high dividends in the 1825-1870 British market. About 36% of the stocks in the first quintile size-sorted portfolio paid high (*dp4*) or very high (*high*) dividends in our dataset. This same figure was around 31% over the 1871-1913 period, and around 20% in the twentieth-century CRSP dataset.

Similar to the other two samples and consistent with prior expectations, smaller stocks tend to have lower past returns and higher rates of delisting in our sample. Smaller stocks also appear to be less liquid as there exists a monotonically negative relationship between size and illiquidity.

From Panel A in Table 3, which presents the performance of the size-sorted portfolios, we can see that there exists some negative relationship between size and stock returns for both the 1-month and 12-month investment horizon. However, this relationship is quite weak. The size premium, defined as the differential returns between the *small* and *big* portfolios, is only significantly different from zero for the 1-month holding period return.

<INSERT TABLE 3>

Using the 1-month holding-period returns, we also calculate the risk-adjusted returns for each portfolio using both the CAPM and Fama-French three-factor model to isolate the influence of differential risks across various portfolios. We regress the equally-weighted portfolio excess returns on the value-weighted excess returns of the market portfolio, *SMB* factor and *HML* factor. The *SMB* and *HML* factors are constructed following Fama and French (1993).[6] The risk-adjusted returns are the intercepts of the CAPM or the Fama-French three-factor regressions. In order to control for possible bias in the estimation of the risk loadings due to the thin trading problem, we report the results for the risk-adjusted returns where the bias is corrected using Dimson's (1979) method.[7]

Panel A of Table 3 suggests that, similar to the evidence for the modern US market, the Fama and French three-factor model performs better than the CAPM in explaining stock returns. The CAPM has difficulties explaining the returns for small stocks since, apart from the portfolio *big*, the CAPM-adjusted returns are significantly different from zero, suggesting that the beta risk alone cannot explain the returns on small stocks. However, this is not the case for the Fama and French three-factor-adjusted returns. We can see that most of the three-factor-adjusted returns are not significantly different from zero. Moreover, the GRS *F*-tests cannot reject the null hypothesis that the three-factor-adjusted returns for the size-sorted portfolios are jointly equal to zero. The last row of Panel A in Table 3 shows that the differential return on the *small* minus *big* portfolio is no longer significantly different from zero after we control for the *SMB* and *HML* factors.

The finding of no size effect in pre-1870 Britain is largely consistent with that of Grossman and Shore (2006), who found that, except for the smallest 5% of stocks, there is no relationship between size and return in the British stock market in the 1871-1913 period. In addition, several studies on the more recent UK stock market have also found little evidence of a size effect (Levis, 1989; Strong and Xu, 1997; Morelli, 2007).

We also calculate the average size premiums for the 45 Januarys between 1826 and 1870 (results not reported). However, we find that size premiums are not significantly different from zero in Januarys. Therefore, the January effect discovered by Keim (1983) and Brown et al. (1983) does not exist in our sample. Notably, the two most popular explanations of the January effect: the tax-loss selling and the window-dressing hypotheses, do not apply in our period since tax rates were effectively zero and there were virtually no institutional investors during this era.

To examine the value effect, we construct five portfolios based on dividend yield. At each December, we calculated the annual dividend yield for the current year for each stock. We assigned the stocks that paid no dividends in the year to the *zdp* portfolio, and divided the remainder into four quartiles. The value premium is defined as the differential return between the high-yielding (*high*) and low-yielding (*low*) portfolios.

Table 4 reports the summary statistics of these dividend-yield-sorted portfolios, as well as the same statistics for the 1871-1913 Britain and the 1926-1999 CRSP datasets. From Panel A of Table 4, we see that, similar to modern financial markets, both zero-yielding and high-yielding stocks tend to have smaller market capitalization. Unlike the size-sorted portfolios, there does not appear to be any relationship between liquidity and value. In addition, there exists no relationship between delisting rate and value.

<INSERT TABLE 4>

Similar to the two other datasets, the growth stocks in the *low* portfolio performed better than the value stocks in the *high* portfolio in the year before they are included in the portfolios. However, the differential past returns between *low* and *high* portfolios are smaller in both

British datasets than the CRSP dataset. In addition, the zero-yielding stocks had much better past performance in the modern US market, while they are the worst-performing stocks in the pre-1913 UK market. This difference may arise because the zero-yielding stocks in the US dataset include many of those that distribute wealth to shareholders through stock repurchases, as well as those that have strong growth potential. In contrast, stock repurchases were not used in nineteenth-century Britain to return earnings to shareholders, and stocks that did not make dividend payments may have been more likely to be those that did not perform well (Braggion and Moore, 2011; Turner et al., 2013). From Panel B of Table 3, we can see that zero-yielding stocks, unlike those in the twentieth-century US market, did not enjoy high returns in our sample. Indeed, they barely outperformed low-yielding stocks.

Table 3 also reveals that the value premium exists in our sample. The unadjusted value premiums, defined as the differential returns between the low-yielding and high-yielding portfolios, are statistically different from zero at the 1% significance level in all cases. The risk-adjusted value premium remains significantly different from zero whether we use the CAPM or Fama and French's (1993) model. In addition, the GRS tests clearly reject the hypothesis that the returns for the dividend-yield-sorted portfolios can be explained by either the CAPM or the Fama-French three-factor model. Notably, the strong influence of dividend yield on stock returns has also been documented in several studies of the modern UK market (Levis, 1989; Morgan and Thomas, 1998; Gwilym et al., 2000).

3.2 Delisting-bias-corrected portfolio performance

In order to address the delisting bias, we attempted to identify which of the 762 stocks disappeared from our sample due to failure. First, we found that 104 of these 762 stocks did not vanish due to bankruptcy since other securities issued by the same firms were still traded on the stock market in 1870. Second, through examining the 1871-1875 issues of the *Investor's*

Monthly Manual, we found that another 77 stocks had simply migrated their listing from the London Stock Exchange to a regional stock exchange.[8] Third, using Lewin (1968), which gives details of the name changes or mergers for railways, and by carefully comparing the names and other data of all the shares in the dataset, we found that 106 stocks, of which 96 were railways, disappeared from the *COE* price list due to name changes or mergers.[9] Fourth, for the remaining 475 stocks, we searched the *Times Digital Archive* and the *London Gazette* to ascertain which stocks delisted due to failure: 112 of these stocks delisted for performance reasons.[10] Another 262 stocks did not delist due to failure because they either merged with another company or were traded on another stock market. We were unable to find information for 111 stocks, even after performing a Google search.

We make two assumptions about these 111 stocks. First, we assume that all these 111 stocks delisted due to failure. Therefore, we categorize altogether 223 stocks as failed stocks in assumption 1 which provides a benchmark about the largest possible influence that the delisting bias could have on portfolio returns. Second, we assume that, among these 111 stocks, only stocks that were listed for more than 36 months before disappearing failed, since it is possible that stocks that were listed for a short time before delisting were never fully established in the first place. In this assumption, there are altogether 171 stocks which were categorized as failed stocks. For both assumptions, we impose a -40% delisting return for the stocks that delisted due to failure and a 0% delisting return for the other delisted stocks.[11]

Table 5 reports the summary statistics for each delisting assumption for portfolios sorted on size and dividend yield. Under assumption 1, 35.42% of the delisted stocks are categorized as having failed, whereas under assumptions 2, 29.98% are categorized as having failed.

<INSERT TABLE 5>

Panel A of Table 5 indicates that there is a clear relationship between size and failure. Smaller stocks are more likely to delist due to failure (i.e., higher *failed/delisted* ratio) and are more likely to fail in general (i.e., higher *failed/total* ratio). This evidence is consistent with the view that smaller stocks are more likely to be marginal stocks that are less likely to survive adverse economic conditions (Chan and Chen, 1991). However, the relationship between value and the various delisting measures is less clear. Zero-yielding stocks are most likely to fail, but among stocks that pay non-zero dividends, stocks in portfolio *high* are most likely to fail, suggesting that they are more likely to be distressed stocks. The failure rate for portfolio *low*, however, is greater than those for portfolios *dp3* and *dp4*.

Panel B in Table 5 reports the delisting-bias-adjusted size premiums and value premiums under our two delisting assumptions. As expected, the delisting adjustment reduces the return on the portfolios with small stocks more so than it does on the portfolios with large stocks. The size premium calculated using the 12-month holding period return has become negative after the delisting-bias adjustments. On the other hand, we can see that the value premiums remain significantly different from zero in all cases after the delisting-bias adjustment.

3.3 Robustness checks

As mentioned above, one of the peculiarities of the British stock market over the sample period is the existence of stocks with partially-paid capital or extended liability. In order to test whether the absence of the size effect and the presence of a value effect are caused by these special stocks, we examine the performance of the size and dividend-yield-sorted portfolios which contain only fully-paid limited liability stocks. Table 6 displays the results. Comparing Panel A of Table 6 to that of Table 3, we can see that the returns of all portfolios are lower in the subsample of standard stocks, suggesting that, in general, stocks with partially-paid capital or extended liability perform better than standard stocks. The reductions in returns are not even across the five size-sorted portfolios. For example, the return for the portfolio *small* drops more than the other four portfolios. Therefore, there is even less evidence of a size effect when we restrict the sample to fully-paid limited liability stocks.

<INSERT TABLE 6>

Panel B of Table 6, which displays the performance for the dividend-yield-sorted portfolios with only fully-paid limited liability stocks, indicates that the value premiums, which were significantly positive in the complete sample are not significantly different from zero. However, as we will see in the Fama-MacBeth regression results, this is not the case when we examine the marginal effects of the value indicator on stock returns.

As the railway industry dominated our sample in the second half of our sample period, we exclude railway stocks to ensure that our conclusions are not being driven by the dominant industry. The results which are displayed also in Table 6 suggest that the exclusion of railway stocks reduces the return to portfolio *small*, while raising the return to portfolio *big*. Hence, the size premiums are even smaller than those in the entire sample. In terms of the dividend-yield-sorted portfolios, the exclusion of railway shares reduces more the returns on portfolio *low* than it does on portfolio *high*. The value premiums are therefore even higher than those in the full sample. Hence, excluding railway stocks from the sample, results in even stronger evidence for the presence of a value effect in this early market.

As the number of ordinary shares is greater than the number of firms due to multiple equity issues, a firm with a large market capitalization may be composed of several stocks with small market capitalization.[12] Consequently, the measurement of size based on the market capitalization of an individual stock may be questionable. However, it is unlikely that this has a large influence on our conclusions. First, more than 65% of multiple issues are in the railway sector, and we have confirmed that excluding railway shares from the analysis does not qualitatively change our conclusions. Second, many equity issues existed temporarily as newly-issued stocks and were quickly subsumed within the main share issue. When we group the stocks issued by each firm in the same month into one firm observation, the number of firm-month observations is only 10% less than the number of stock-month observations.

An examination of the performance of portfolios formed on the firm's size and dividend yield confirms the above conjecture. We calculate the market capitalization of a firm as the sum of market capitalization of its listed constituent ordinary stocks. The dividend yield, 1-month, and 12-month holding-period return of a firm are the equally-weighted averages of the firm's constituent stocks. In general, as shown in Table 6, we find that the results are in line with the stock-level portfolios.

4. Fama-MacBeth regressions

Previous studies of modern financial markets have highlighted the size pattern in the value premiums and the correlation of the size and value variables with many other stock characteristics (Loughran, 1997; Fama and French, 2006; Amihud and Mendelson, 1989). Due to the relatively small number of stocks in our sample, Fama-MacBeth regressions may better allow us to examine the marginal effect of size and value on stock returns than a double-sorting or triple-sorting method within the portfolio framework. In addition, it also allows us to examine the relationship between stock returns and several other stock characteristics, such as beta, illiquidity, momentum and reversal, in the nineteenth-century London stock market.

We apply the Fama-MacBeth methodology as follows. At each month of year t, we regress the return of an individual stock on selected explanatory variables in year $t-1$. The first regression starts in January 1828 and the last regression ends in December 1870. For each coefficient on the explanatory variables, we have 516 values, each corresponding to one month between January 1828 and December 1870. The time-series average of these 516 values and the related *t*-statistics tell us whether the relevant explanatory variable helps to explain stock returns.

We test two specifications. The first specification (S1) includes the following explanatory variables simultaneously: 1) the natural logarithm of a stock's market capitalization at December of year *t-1* (*size*); 2) the dividend yield in year *t-1*, calculated as the sum of dividends paid in the year divided by the December stock price (*value*); 3) the annual return of the stock in year *t-1* (*momentum*); 4) the average annual return of the stock in the past 3 years (*reversal*); 5) a measure of stock liquidity in year *t-1* (*illiquidity*)[13]; 6) the market risk of a stock in year *t-1* (*beta*).[14] We also include in the regression the stock return in the last month (*return_lm*) in order to control for the bid-ask bounce. To control for the delisting bias, we also run the same regressions with the delisting-bias-adjusted stock returns.

<INSERT TABLE 7 >

As can be seen in Table 7, which reports the results for the Fama-MacBeth regression, although the coefficients on the size indicator were significantly different from zero in specification 1 when we use the unadjusted stock return as the dependent variable, it is not the case for the regression of delisting-bias-adjusted returns. The size effect, therefore, does not seem to exist in this early stock market once we control for the delisting bias and is economically small when we do not control it. The coefficients on value are substantial both economically and statistically. Furthermore, Table 7 shows that the value effect is robust to the delisting-bias adjustments. In summary, the results of the regression analysis are largely consistent with the results from the portfolio analysis on the existence of the size and value effects in our sample.

The coefficients on *beta* and *illiquidity* are all consistent with prior expectations. That is, stocks with greater market risk and less liquidity tend to have greater return. In addition, the regression results suggest that there is some evidence of a momentum effect in this early market. The coefficients on the *momentum* variable are significantly different from zero at the 10% level in all cases. This evidence is consistent with findings from the modern UK stock market (Liu et al., 1999; Hon and Tonks, 2003).

Interestingly, although previous studies document the existence of a reversal effect in the modern UK market (Dissanaike, 1999; Galariotis et al., 2007; Wu and Li, 2011), results from the historical UK market suggest otherwise. We find that the coefficients on the *reversal* variable are not significantly different from zero indicating that the reversal effect may not exist in our sample. This result implies that the overreaction hypothesis cannot be the sole explanation for the reversal effect discovered in the modern era. If investor's overreaction causes the reversal effect, the nonexistence of it in our sample suggests that the nineteenth-century investors did not overreact to price-influencing information, which is hard to believe given that the market in this era was dominated by individual investors. On the other hand, the nonexistence of the reversal effect should be expected in a market without taxes if its existence is due to tax-loss selling behavior.

In the second specification (S2), in addition to the variables mentioned above, we also include in the regression a dummy variable (s*pecial_stock*) which indicates whether the stock had partially-paid capital or extended liability, and the interaction term between this dummy variable and the size variable (*size_special*) and the value variable (*value_special*). The purpose of specification 2 is to test the distress risk hypothesis. If size and value indicators are proxies for distress risk, we expect to find that the size effect and value effect to be much stronger in the special stocks. Taking the value effect as an example, this can be seen more clearly through the following reasoning: if the value premium appears due to the greater distress risk of the value stocks, then value premium = (distress risk of value stock – distress risk of growth stock) × price of distress risk. As distress will have much greater influence on the personal wealth of the shareholders of special stocks, the price of distress risk should be higher for the special stocks than the standard stocks. Therefore, the value premium of special stocks should be higher than the value premium of standard stocks.

The results of specification 2, as reported in Table 7, indicate that the coefficients on the *special_stock* dummy variables are significantly positive, suggesting that the stocks with extended liability and uncalled capital have greater returns than the standard limited liability stocks. This evidence is consistent with the findings in Acheson et al (2012) which, by excluding other possibilities, conclude that this arises due to the possible call on shareholders' personal wealth for these special stocks. That is, although the special stocks may not necessarily have higher distress risk, the costs to their shareholders of distress are higher so that shareholders demanded higher returns to compensate such greater costs of distress. The positive coefficients on the *special_stock* dummy, therefore, suggest that the price of distress risk may indeed be higher for special stocks than for the standard stocks.

However, our results also reveal that the coefficients on the *size_special* and *value_special* variables are not significantly differently from zero. Hence, the negative relation between size and return, and the positive relation between value and return are not significantly stronger in the special stocks. As explained previously, the opposite should be observed if the distress risk explanation for the size and value effects holds.

5. Conclusions

In this study, we make use of a unique dataset for the British stock market for the period 1825 to 1870 to investigate whether the two asset pricing anomalies which have attracted the most attention in the literature, namely the size and value effects, existed in this nascent capital market. We also examine the relationship between stock return and several other stock characteristics, namely, beta, illiquidity and short-term and long-term past returns. In general, the stock return patterns in this nascent stock market show both similarities with and differences to the modern market. Thus, these results allow researchers to evaluate the validity of several well-known stock-return patterns discovered in modern stock markets.

Our first main finding is that the size premium is not significantly different from zero. The size premium is reduced even further when we correct for delisting bias since smaller stocks are subject to a greater delisting bias. Our finding is also robust when we limit the sample to either non-railway shares or fully-paid limited liability stocks. In addition, multiple equity issues do not influence our findings. We also find that the Fama-French three-factor model largely explains the performance of size-sorted portfolios. The nonexistence of the size effect in this early stock market is consistent with the view that some of the anomalies discovered in modern era may simply be the result of data-snooping. Given the instability of the size premium over time, further empirical studies need to focus on the long-term performance of stock returns in order to understand what factors may have caused the advent and disappearance of the size effect and which institutional, financial or behavioral reasons could explain the variation of the size premium over time.

Our second main finding is that the value premium is positive in this early stock market. The adjustments for delisting bias and multiple equity issues reduce the level of value premium slightly, but it remains significantly different from zero. In addition, neither the Fama-French three-factor model nor the CAPM are able to explain away the significantly positive intercept on the portfolio with the highest dividend yield. The fact that the value effect also exists in the nineteenth-century London market suggests that, unlike the size effect, it is a pervasive phenomenon and there may be economic or behavioral reasons for its existence.

In our empirical analysis, we make use of the existence of stocks with unlimited liability and uncalled capital in the early London market to test the distress risk explanation of the value effect. However, we find little evidence to support this popular explanation for the value effect.

Thus, future theoretical and empirical research may need to focus on different types of systematic risk or behavioral reasons to explain the value effect.

Thirdly, even though the stock market investigated in this study is more than 150 years old, the stock return patterns are in many cases consistent with the modern stock market. For example, in this early market, the market risk and illiquidity both positively influence the stock return and there was also some evidence of a momentum effect. However, we find no evidence of the reversal effect. Considering the institutional environment of the London market in this era, we think that this may suggest that the appearance of the reversal effect in the modern market is due to investors' tax-loss selling behavior rather than investor overreaction.

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Table 1. Descriptive Statistics for the Main Variables in the Course of the Exchange Dataset, 1825-1870

	Dividend rate (%)	Stock price (£)	Nominal value (£)	Par value (£)	Par value/ nominal value	Number of shares
Panel A: All stocks						
Mean	7.12	68.09	69.53	46.88	0.73	20,712
Median	5.00	27.50	50.00	25.00	1.00	10,000
Standard deviation	18.81	154.22	84.33	48.01	0.37	32,785
Obs	122,414	94,438	122,414	122,414	122,414	122,414
Panel B: Fully-paid limited liability stocks						
Mean	7.59	101.53	70.31	70.31	1.00	16,190
Median	4.50	53.00	83.50	83.50	1.00	6,000
Standard deviation	24.31	201.35	50.56	50.56	0.00	30,952
Obs	62,737	49,950	62,737	62,737	62,737	62,737
Panel C: Stocks with either uncalled capital or extended shareholder liability						
Mean	6.63	30.48	68.72	22.24	0.44	25,466
Median	5.00	16.50	50.00	13.00	0.35	14,400
Standard deviation	10.20	47.95	109.08	29.28	0.33	33,964
Obs	59,677	44,488	59,677	59,677	59,677	59,677

Notes: The number of observations for stock price exclude the months where a stock price is missing.

Table 2. Summary Statistics of Size-Sorted Portfolios

	small	**s2**	**s3**	**s4**	**big**
Panel A: British stock market, 1825-1870					
size (£)	41,487	127,642	274,330	583,491	2,374,861
share (%)	1.31	4.00	8.32	17.42	68.95
DP (%)	4.98	4.94	4.64	4.48	4.44
no. stock	32	32	32	32	34
delisting rate (%)	12.56	6.79	6.22	4.37	3.60
past return (%)	1.61	5.84	6.98	8.68	7.64
illiquidity	0.17	0.13	0.10	0.08	0.04
zdp (%)	38.92	20.85	17.43	11.05	6.45
low (%)	13.15	16.99	21.71	24.37	26.78
dp3 (%)	11.87	16.07	17.27	23.72	35.88
dp4 (%)	14.34	21.43	20.78	24.66	22.66
high (%)	21.73	27.47	25.07	18.78	12.63
Panel B: British stock market, 1870-1913					
share (%)	0.60	1.40	2.90	6.90	86.30
past return (%)	-3.23	7.05	7.70	9.75	10.33
delisting rate (%)	9.75	3.00	2.40	2.90	3.56
zdp (%)	48.10	24.35	19.55	16.05	15.34
low (%)	9.30	16.00	17.35	21.95	31.58
dp3 (%)	11.18	16.60	21.60	21.25	23.24
dp4 (%)	12.73	20.65	20.75	22.45	17.71
high (%)	18.73	22.35	20.80	18.30	12.12

R_t - R_f (%)	9.03	1.10	1.45	1.75	2.71
Panel C: US stock market, 1926-1999					
share (%)	0.50	1.50	3.50	9.30	85.10
past return (%)	4.20	15.30	18.70	19.15	16.51
delisting rate (%)	13.65	6.85	5.80	5.25	3.86
zdp (%)	66.10	42.90	29.80	19.25	8.28
low (%)	7.65	11.90	15.65	20.55	28.04
dp3 (%)	6.33	12.50	16.65	21.70	26.36
dp4 (%)	7.80	14.55	18.50	20.50	22.07
high (%)	12.18	18.15	19.40	18.00	15.33
R_t - R_f (%)	24.38	9.50	7.65	5.55	4.78

Notes: *small, s2, s3, s4* and *big* represent the five quintiles formed on market capitalization. *size* is the average market capitalization for stocks included in each portfolio at the time of formation. *DP* is the average dividend yield for stocks included in each portfolio at the year of formation. *share* is the fraction of the total sample market capitalization of each portfolio. *no. stock* is the average number of stocks in each portfolio. *illiquidity* is the proportion of months with no trades in the year of portfolio construction. *delisting rate* is the percentage of stocks that disappeared from the portfolio in the year after the formation. *past return* represents the annual return of stocks in the year of formation. *zdp, low, dp3, dp4,* and *high* show the percentage of stocks in each size-sorted portfolio that pay no dividends, and that have dividend yield in the lowest, 2nd lowest, 2nd highest, and highest quartiles of dividend-paying stocks. The statistics in Panel B and Panel C are calculated from Tables 3, 4 and 5 of Grossman and Shore (2006). R_t - R_f represents the annual excess return of each portfolio in the year after formation.

Table 3. Performance of Portfolios Sorted on Size and Dividend Yield

	Unadjusted returns		**CAPM-adjusted returns**		**Fama and French three-factor-adjusted returns**			
	1-month holding-period	12-month holding-period	CAPM-adjusted	beta	three-factor-adjusted	beta	SMB loadings	HML loadings
Panel A: Portfolios formed on size								
small	0.730 (4.88)	7.379 (4.63)	0.387 (2.74)	0.698	0.203 (1.48)	0.877	0.793	0.241
s2	0.620 (5.90)	6.880 (4.63)	0.280 (3.09)	0.694	0.124 (1.45)	0.843	0.655	0.220
s3	0.635 (5.68)	6.459 (5.83)	0.229 (3.07)	1.061	0.093 (1.50)	1.202	0.716	0.068
s4	0.545 (6.02)	5.733 (5.09)	0.148 (2.79)	0.958	0.093 (1.75)	1.014	0.167	0.128
big	0.419 (4.85)	5.108 (4.77)	0.022 (0.85)	0.953	0.018 (0.67)	0.959	-0.009	0.026
small-big	0.311 (2.13)**	2.270 (1.41)	0.364 (2.56)**		0.185 (1.33)			
GRS test			4.48***			1.74		
Panel B: Portfolios formed on dividend yield								
zdp	0.599 (3.11)	4.685 (2.09)	0.127 (0.86)	1.637	-0.084 (0.58)	1.871	0.932	0.230
low	0.509 (5.38)	5.647 (4.85)	0.128 (1.88)	0.842	0.085 (1.37)	0.907	0.472	-0.188

dp3	0.479	6.406	0.122	0.680	0.064	0.747	0.279	0.039
	(7.34)	(5.83)	(3.04)		(1.59)			
dp4	0.516	5.819	0.162	0.643	0.100	0.696	0.177	0.162
	(7.65)	(6.65)	(3.42)		(2.22)			
high	0.896	11.053	0.523	0.705	0.332	0.855	0.507	0.540
	(8.47)	(7.02)	(6.02)		(5.63)			
high-low	0.387	5.406	0.395		0.247			
	(3.75)***	(3.30)***	(3.81)***		(3.45)***			
GRS test			8.96***			8.01***		

Notes: small, *s2*, *s3*, *s4* and *big* represent the five quintiles formed on market capitalization. *zdp* is the portfolio of stocks which paid zero dividends. *low*, *dp3*, *dp4*, and *high* represent the four quartiles formed on dividend yield. The time-series mean returns reported in the table are the equally-weighted average returns of stocks included in the portfolios. The CAPM-adjusted returns are the intercepts in the following regressions: $R_t-R_{f,t}=a+b_0(R_{m,t}-R_{f,t})+b_1(R_{m,t-1}-R_{f,t-1})+b_2(R_{m,t-2}-R_{f,t-2})+e_t$. The regressions use the 1-month holding period returns. The monthly yield on 3% Consols is the proxy for the risk-free rate. The three-factor-adjusted returns are the intercepts in the following regressions:

$$R_t-R_{f,t}=a+b_0(R_{m,t}-R_{f,t})+b_1(R_{m,t-1}-R_{f,t-1})+b_2(R_{m,t-2}-R_{f,t-2})+s_0SMB_t+s_1SMB_{t-1}+s_2SMB_{t-2_t}$$
$$+h_0HML+h_1HML_{t-1}+h_2HML_{t-2}+e_t$$

The *SMB* and *HML* factors are calculated following Fama and French (1993). The reported *betas* are the sums of b_0, b_1 and b_2. Similarly, the *SMB loadings* are the sums of s_0, s_1 and s_2. The *HML loadings* are the sums of h_0, h_1 and h_2. *, **, and *** represent significant at 10%, 5% and 1% respectively. The GRS *F*-statistics test whether the regression intercepts are jointly equal to zero.

Table 4. Summary Statistics of Dividend-Yield-Sorted Portfolios

	zdp	low	dp3	dp4	high
Panel A: British stock market, 1825-1870					
size (£)	224,431	675,842	1,218,467	799,623	377,516
share (%)	7.97	21.42	33.67	23.78	13.16
DP (%)	0.00	2.78	4.50	5.50	9.79
no. stock	29	33	33	33	35
past return (%)	-2.91	9.26	8.18	6.99	6.88
delisting rate (%)	11.30	6.63	3.84	4.65	6.53
illiquidity	0.14	0.10	0.08	0.09	0.11
small (%)	43.25	12.29	11.24	13.66	20.39
s2 (%)	23.06	16.14	15.33	20.82	25.88
s3 (%)	17.34	20.93	16.52	19.91	23.97
s4 (%)	10.35	24.03	22.66	23.58	17.81
big (%)	5.99	26.61	34.25	22.03	11.96
Panel B: British stock market, 1870-1913					
share (%)	13.30	37.50	25.60	12.90	8.70
DP (%)	0.00	3.70	5.30	6.60	11.00
past return (%)	4.00	11.80	9.10	8.10	7.60
delisting rate (%)	5.40	4.10	2.70	2.00	2.20
R_t - R_f (%)	-1.90	0.60	1.40	2.60	2.10
Panel C: US stock market, 1926-1999					
share (%)	6.40	30.70	25.80	21.90	15.30
DP (%)	0.00	2.30	4.10	5.70	13.30

past return (%)	22.30	27.30	16.90	10.80	7.00
delisting rate (%)	7.50	5.80	5.10	3.40	2.80
R_t-R_f (%)	9.80	4.20	6.10	8.50	8.00

Notes: *zdp* is the portfolio of stocks which paid zero dividends. *low*, *dp3*, *dp4*, and *high* represent the four quartiles formed on dividend yield. *size* is the average market capitalization for stocks included in each portfolio at the time of formation. *DP* is the average dividend yield for stocks included in each portfolio at the year of formation. *share* is the fraction of the total sample market capitalization of each portfolio. *no. stock* is the average number of stocks in each portfolio. *illiquidity* is the proportion of months with no trades in the year of portfolio construction. *delisting rate* is the percentage of stocks that disappeared from the portfolio in the year after the formation. *past return* represents the annual return of stocks in the year of formation. *small, s2, s3, s4,* and *big* show the percentage of stocks in each dividend-yield-sorted portfolio that have market capitalization in one of the five portfolios formed on size. The statistics in Panel B and Panel C are obtained from Tables 9 and 10 of Grossman and Shore (2006). R_t-R_f represents the excess return of each portfolio in the year after formation.

Table 5. Summary Statistics for the Delisting Assumptions and Delisting-Bias-Adjusted Returns

	Assumption 1		**Assumption 2**	
Panel A: Summary statistics for the delisting assumptions				
	failed/delisted (%)	failed/total (%)	failed/delisted (%)	failed/total (%)
market	35.42	1.80	29.98	1.53
Portfolios formed on size				
small	45.81	5.93	37.61	4.78
s2	26.34	1.61	22.49	1.42
s3	19.04	1.01	19.04	1.01
s4	7.31	0.50	7.31	0.50
big	4.76	0.05	4.76	0.05
Portfolios formed on dividend yield				
zdp	43.77	4.47	37.02	3.63
low	13.54	0.61	12.50	0.53
dp3	16.35	0.51	14.42	0.40
dp4	24.52	0.99	24.52	0.99
high	30.95	1.87	27.16	1.61
Panel B: Delisting-bias-adjusted returns				
	1-month holding-period	12-month holding-period	1-month holding-period	12-month holding-period
small-big	0.002	-1.589	0.062	-1.018

	(0.01)	(1.09)	(0.41)	(0.72)
high-low	0.327	4.154	0.334	4.236
	(3.21)***	(2.66)**	(3.29)***	(2.71)**

Notes: failed/delisted is the percentage of delisted stocks that are identified as failed under various assumptions. *failed/total* is the percentage of all stocks in each portfolio that are identified as failed. In the *market* row, all the variables are calculated using the market portfolio. In Assumption 1, all the 111 stocks for which the delisting reasons cannot be identified (and the 112 stocks that were known to have failed) are categorized as having failed. Assumption 2 is similar to Assumption 1 except that, among the 111 unidentified delisting stocks, only those which were listed for at least 36 months were categorized as having failed. *small*, *s2*, *s3*, *s4*, and *big* represent the five size-sorted portfolios. z*dp*, *low*, *dp3*, *dp4* and *high* represent the five portfolios formed on dividend yield. *, **, and *** represent significant at 10%, 5% and 1% respectively.

Table 6. Performance of Size-Sorted and Dividend-Yield-Sorted Portfolios in Subsamples

	Fully-paid stocks		**Non-railway stocks**		**Firm-level analysis**	
	1-month holding-period	12-month holding-period	1-month holding-period	12-month holding-period	1-month holding-period	12-month holding-period
Panel A: Portfolios formed on size						
small	0.439	4.706	0.696	6.748	0.612	0.505
s2	0.548	6.034	0.597	6.324	0.645	0.463
s3	0.495	4.876	0.614	6.541	0.630	0.616
s4	0.409	4.114	0.527	5.521	0.544	0.562
big	0.380	4.321	0.490	5.456	0.482	0.488
small-big	0.059	0.642	0.206	1.276	0.131	0.168
	(0.36)	(0.34)	(1.30)	(0.88)	(0.84)	(0.16)
Panel B: Portfolios formed on dividend yield						
zdp	0.253	3.322	0.563	4.488	0.577	5.186
low	0.480	5.454	0.471	4.774	0.507	4.903
dp3	0.322	5.055	0.482	6.055	0.483	5.073
dp4	0.494	5.653	0.575	6.582	0.576	5.370
high	0.664	7.815	0.884	11.269	0.855	7.425
high-low	0.185	2.361	0.413	6.494	0.348	2.522
	(1.54)	(1.52)	(3.77)***	(3.96)***	(3.41)***	(2.49)**

Notes: small, s2, s3, s4 and *big* represent the five quintiles formed on market capitalization. *zdp* is the portfolio of stocks which paid zero dividends. *low, dp3, dp4*, and *high* represent the four quartiles formed on dividend yield. The time-series mean returns reported in the table are the equally-weighted average returns of stocks included in the portfolios. Fully-paid stocks refers to the subsample of stocks which have limited liability and are fully paid up. Non-railway stocks refers to the subsample of all non-railway stocks. Firm-level analysis refers to the subsample where the portfolios are formed on a firm rather than stock level. *, **, and *** represent significant at 10%, 5% and 1% respectively.

Table 7. Fama-MacBeth Regression Results

	S1			**S2**		
	Unadjusted return	Delisting assumption 1	Delisting assumption 2	Unadjusted return	Delisting assumption 1	Delisting assumption 2
constant	0.929	0.445	0.422	0.632	0.310	0.291
	(2.14)**	(0.99)	(0.94)	(1.36)	(0.65)	(0.61)
size	-0.074	-0.037	-0.036	-0.053	-0.030	-0.029
	(2.50)**	(1.22)	(1.19)	(1.70)*	(0.96)	(0.93)
value	5.749	5.869	5.876	4.627	4.68	4.719
	(3.68)***	(3.62)***	(3.62)***	(2.54)**	(2.48)**	(2.50)**
momentum	0.499	0.601	0.595	0.503	0.597	0.589
	(1.72)*	(2.06)**	(2.03)**	(1.75)*	(2.06)**	(2.03)**
reversal	-0.156	-0.007	-0.012	-0.147	-0.004	-0.009
	(0.36)	(0.05)	(0.08)	(0.35)	(0.03)	(0.06)
illiquidity	0.753	0.435	0.470	0.693	0.405	0.441
	(3.87)***	(2.11)**	(2.29)**	(3.49)***	(1.91)*	(2.09)**
beta	0.406	0.393	0.401	0.413	0.423	0.430
	(3.31)***	(3.06)***	(3.13)***	(3.35)***	(3.32)***	(3.39)***
return_lm	-8.877	-8.676	-8.717	-8.835	-8.639	-8.679
	(9.14)***	(8.89)***	(8.91)***	(9.06)***	(8.82)***	(8.84)***
special_stock				0.224	0.156	0.156
				(2.81)***	(1.96)*	(1.95)*
size_special				-0.058	0.011	0.012
				(1.02)	(0.19)	(0.21)

value_special				2.719	3.608	3.49
				(0.90)	(1.15)	(1.12)
obs	123	123	123	123	123	123
R^2	0.118	0.115	0.116	0.137	0.136	0.136

Notes: The Fama-MacBeth regressions are carried out by regressing the monthly returns on individual stocks in year *t* on several explanatory variables for the same stock in year *t-1*. In Assumption 1, all the 111 stocks for which the delisting reasons cannot be identified (and the 112 stocks that were known to have failed) are categorized as having failed. Assumption 2 is similar to Assumption 1 except that, among the 111 unidentified delisting stocks, only those which were listed for at least 36 months were categorized as having failed. *constant* is the intercept of the regression. *size* is the natural logarithm of the market capitalization of the stock in December of year *t-1*. *value* is the dividend yield of the stock in year *t-1*. *beta* represents the market risk of individual stock in year *t-1*. *return_lm* is the total return for the stock in the prior month. *momentum* is the total return for the stock in year *t-1*. *reversal* is the average return for the stock in the past 3 years. *illiquidity* is the proportion of months with no trades in year *t-1*. s*pecial_stock* is a dummy variable that equals one if the stock has partially-paid capital or extended liability. *size_special* represents the interaction terms between the s*pecial_stock* dummy variable and the demeaned *size*. *value_special* represents the interaction terms between the s*pecial_stock* dummy variable and the demeaned *value*. *obs* column shows the average number of observations per monthly regression. R^2s are adjusted for degrees of freedom. *, **, and *** indicate significant level of 10%, 5% and 1% respectively.

[1] In order to protect themselves from potential questions raised by their clients, stock-brokers usually marked the bargain (i.e., entered it on a slip of paper, which they signed and put in a box) when a trade was completed. This bargain was included in the official record of business done, which was given in the Stock Exchange price list (Withers, 1910, p.258).

[2] However, dual capacity existed in the nineteenth century as sometimes brokers also made a market to stimulate interest in particular securities, and jobbers sometimes had direct contacts with outside large investors (Michie, 1999, pp. 113-4).

[3] Each individual stock price series was analyzed so as to pick up data-inputting errors or printing mistakes in the *Course of the Exchange*. If a share price was substantially out of line with prices either side of it, the *Course of the Exchange* was double-checked, and in the event that it was not a data-inputting error, it was deleted and the previous reported price was used as the current month's price. This, however, was extremely uncommon.

[4] Dimson et al. (2003) suggest that the dividend yield is a good measure of value in the modern UK market.

[5] For both the size-sorted and the dividend-yield-sorted portfolios, the findings are similar when we use the value-weighted returns.

[6] We construct *Small* and *Big* portfolios using the median market capitalization of stocks at December each year as the breakpoint; we also construct *High*, *Medium*, and *Low* portfolios using the 30th and the 70th percentiles of the dividend yield at December as the breakpoints. From these, we get six intersection portfolios, namely, *Small High*, *Small Medium, Small Low*, *Big High*, *Big Medium*, and *Big Low*. *SMB* is the average return on the three small portfolios minus the average return on the three big portfolios. *HML* is the average return on the two high portfolios minus the average return on the two low portfolios. The zero-yielding stocks are excluded in constructing the *SMB* and *HML* factors.

[7] To determine the number of leads and lags, we regressed the excess returns on the size-sorted and dividend-yield-sorted portfolios on the current market excess return, and also its n lags and m leads. We then calculated the market beta as the value-weighted average of the individual portfolio betas for the five size-sorted portfolios or the five dividend-yield-sorted portfolios. Among all the combinations of lags and leads we tried, the combination of 2 lags and 0 leads produces the market beta that is closest to 1 for both the size-sorted portfolios and dividend-yield-sorted portfolios. Adjusting betas using the Fowler and Rorke (1983) correction leads to trivial changes in the betas.

[8] The *Investor's Monthly Manual* published information for stocks listed in both London and regional stock exchanges from 1864 onwards.

[9] Mergers were uncommon in the UK (apart from railways) until the 1880s and 90s (Sykes, 1926; Cottrell, 1980; Supple, 1970, pp.298-9)

[10] The *London Gazette* is an official publication where statutory notices are published. The *Times Digital Archive* is a fully-searchable archive of the *The Times* newspaper, which had by far the largest and widest circulation of any newspaper in the nineteenth century.

[11] The -40% delisting return was chosen because Shumway (1997) reports that NYSE and AMEX firms that disappeared due to performance reasons had roughly a -40% delisting return. Replacing the -40% delisting return with the -55% delisting return for the stocks which delisted from the Nasdaq for poor performance (Shumway and Warther, 1999), does not change our conclusions.

[12] Apart from the railway sector, preference or preferred shares were uncommon in this period (Jefferys, 1977).

[13] There is no data on trading volume, bid-ask spread or turnover rate in this early stock market. We try to measure stock liquidity with the available information on stock prices. In particular, we measure the annual liquidity of a stock as the proportion of months with no trades in a particular year. This measure mainly focuses on how

frequently a stock was traded so that an investor could sell the stock easily when necessary. It is in essence a measure of illiquidity because greater incidence of no trades indicates a less liquid stock.

[14] To reduce the errors-in-variables problem, the market risk of individual stocks is estimated as follows. First, we form sixteen portfolios based on size (four quartiles) and dividend yield (four quartiles) at December each year. The equally-weighted returns for the sixteen portfolios are calculated in the following year, and this process is repeated between 1825 and 1869 so that each portfolio has a time-series of monthly returns between January 1826 and December 1870. Second, we estimate the market betas for the sixteen portfolios by regressing the portfolio excess returns on the market excess return. Third, the beta of each stock at each year is the beta of the portfolio in which this stock is assigned to in that particular year.